

## عنوان مقاله:

In-situ modeling of mechanical stress distribution inside a fuel cell working with sulfonated poly(ether ether ketone) membrane

## محل انتشار:

پنجمین همایش هیدروژن و پیل سوختی (سال: 1399)

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## خلاصه مقاله:

Although perfluorinated proton exchange membranes (PEMs), such as Nafion® have shown quite acceptable electrochemical performance and chemical stability, their high cost and relatively weak thermo-mechanical properties have limited their applications in the fuel cells. Thus, hydrocarbon-based PEMs with strong aromatic backbone, reasonable production cost, and less environmental impact have been introduced. However, durability tests should be carried out to evaluate their reliability in the harsh fuel cell condition, namely mechanical stresses during assembly or water content fluctuation. In this study, using finite element method and COMSOL multiphysics, a 3D model is developed to predict the stress distribution in the cell structure and local stress concentration points within the sulfonated poly(ether ether ketone) (SPEEK) membrane in a H<sub>2</sub>/air fuel cell. The water production and transfer mechanisms inside the fuel cell were incorporated and the swelling-induced mechanical stress together with mechanical stress due to the external clamping pressure of 1 MPa were known responsible for the obtained stress distribution. Von Mises stress is used to indicate the vulnerable domains in the cell and it was found that the PEM, in particular at the edges endure the highest stress value of 46 MPa, suggesting the importance of employing an appropriate frame with similar mechanical properties to SPEEK for membrane-electrode assembly fabrication.

## کلمات کلیدی:

Modeling; Fuel cell; Mechanical degradation; Proton exchange membranes

## لینک ثابت مقاله در پایگاه سیویلیکا:

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